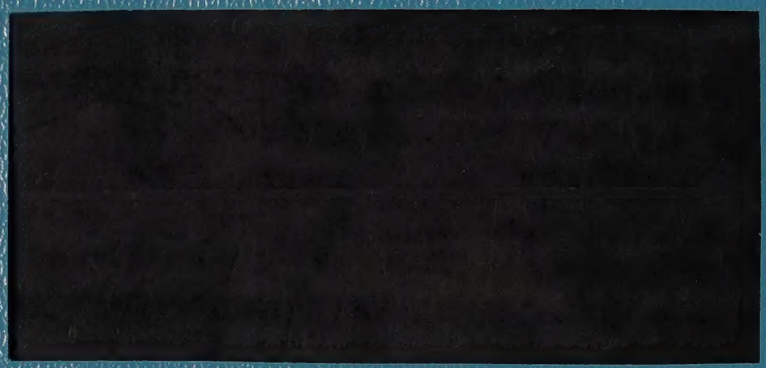
ITHACA, N.Y.



INSTRUCTION AND MAINTENANCE MANUAL

ITHACO MODEL 471

STRAIN GAGE AMPLIFIER

ITHACO INC.
735 West Clinton Street
Ithaca, New York 14850
Telephone 607-272-7640

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LIST OF DRAWINGS

DESCRIPTION	ASSEMBLY	ELEM. DIAGRAM
MODEL 471 STRAIN GAGE AMPLIFIER	D41001	D40999
Amplifier Card	D41000	
Galvo Driver Option	C30853G1	C30852
Galvo Modification Instructions	A11202	

FIGURE 1 MODEL 471 FUNCTIONAL BLOCK DIAGRAM

SECTION 1

GENERAL DESCRIPTION

1.1 DESCRIPTION

The Model 471 is a strain gage amplifier with integral current source for dynamic strain measurements. Its use eliminates many of the problems associated with static types of systems, and presents additional advantages:

1. No bridge balancing, no balance drift, and minimum temperature effects.

2. No inaccuracy due to resistance of wiring to gage.

3. Gage resistance and gage factor are normalized by use of multi-turn controls.

4. Full scale output of 1 volt peak for peak micro-strain units in discrete ranges from 10 to 30,000.

5. Greater sensitivity, stability, and lower noise than other types of equipment.

The gage is excited single ended by a precise current source, and the output is conditioned by a low noise AC amplifier with 1% gain stability.

Input and output connections are made through rear panel BNC's. Power and Cal connections are made through the rear panel 16 pin Blue Ribbon Connector.

A front panel BNC is provided as a test point to check gage voltage.

1.2 SPECIFICATIONS

(see attached sheet)

IPS 105

MODEL 471

DYNAMIC STRAIN GAGE AMPLIFIER w/ constant current excitation

ITHACO

735 WEST CLINTON STREET ITHACA NEW YORK 14850 PHONE 607-272-7640 TWX 510-255-9307

Specifically designed for dynamic measurements, the Model 471 Amplifier eliminates many of the problems associated with static systems. Gages are excited single-ended by a precision current source, and outputs conditioned by a low noise A–C amplifier with 1% gain stability. Advantages are as follows:

- NO BRIDGE BALANCING – NO BALANCE DRIFT – MINIMUM TEMPERATURE EFFECTS
- NO INACCURACY DUE TO RESISTANCE OF GAGE LEADS
- GAGE RESISTANCE AND GAGE FACTOR SET BY FRONT PANEL DIALS
- 1 VOLT FULL SCALE OUTPUT IN SIX RANGES FROM 10 MICROSTRAIN TO 30,000 MICROSTRAIN
- GREATER SENSITIVITY, BETTER STABILITY, AND LOWER NOISE

SPECIFICATIONS

CONTROLS

GAGE FACTOR	3 turn dial, range 1.00 to 4.00
GAGE RESISTANCE	10-turn dial, range 100 to 1000 ohms
GAGE EXCITATION	Switch selects 0.0, 2.5 ma or 25 ma
CALIBRATE	Control on Power Supply, 1v peak out, 1 KHz
STRAIN RANGE 25ma excitation 2.5ma excitation	 1v peak out for 10, 30, 100, 1000, 3000 peak microstrain 1v peak out for 100, 300, 1000, 3000, 10,000, 30,000 peak microstrain
OPEN GAGE ALARM	Panel light, indicates open circuit in gage or wiring

ELECTRICAL CHARACTERISTICS

GAGE EXCITATION	2.5 or 25 ma, (max. gage R is 400 ohm for 25 ma) withstands short or open circuit
CURRENT SOURCE REFERENCE	Mounted in mounting frame
OVERALL ACCURACY	±3% at midband (includes gain and excitation current accuracies)
PASSBAND	–3% 2 Hz and 10 KHz, –3 db nominal at 0.7 Hz to 25 KHz
BROADBAND NOISE *	Worse case: 0.5μstrain rms (120 ohm gage, gage factor = 2) Typical: 0.25μstrain rms
OUTPUT IMPEDANCE	20 ohm, DC coupled with 10mv maximum DC offset
MAXIMUM OUTPUT	7 volts peak into 500 ohm load, 1.4 volts peak into 100 ohms
OPTIONAL GALVO OUTPUT	Supplies up to ±85ma, gain set by screwdriver adjustment on front panel
OPERATING TEMPERATURE	0° to +55°C

*with 25 ma excitation. Includes hum and ripple except for pickup at gage. Gage grounded only inside amplifier.

CALIBRATION

CALIBRATE	1 v peak (0.707 v rms) 1 KHz ± 1% at output

MECHANICAL

CASES	Model S11 w/option 01	Mounting for 7 plug-in amplifiers plus power supply in 7" by 19" rack space
	Model S21 w/option 01	Mounting for 3 plug-in amplifiers plus power supply in portable case
POWER SUPPLY	Model P16	Supplies all power required for operation of 471 amplifiers plus calibration oscillator
CONNECTIONS		
	Input	BNC on rear of amplifier
	Output	BNC on rear of amplifier
	Optional Galvo Output	MS connector on rear of mounting frame
	Input Monitor	BNC on front panel
PANEL		7" high x 2" wide, black panel, white lettering

NOTES ON CALIBRATION

In conventional bridge-type systems, calibration is accomplished by switching a known resistance across the gage. This procedure imposes a known Δ R/R on the gage arm of the bridge, and permits overall calibration of the bridge-amplifier-readout system. For example, if a 120 ohm gage is shunted with 1 megohm, and the readout device shows 1 volt peak change at the amplifier output, the system gives 1 volt out for 120 parts per million change of the gage resistance. If gage factor is 2.07, the above computes to be 120 ÷ 2.07 p.p.m. strain, or 58.0 microstrain for 1 volt peak output.

The Model 471 dynamic system is inherently simpler to operate. No computation is required, because full scale output is calibrated in microstrain units. The use of gage-calibration shunt resistors has been avoided because it is not practicable to obtain by this method a full scale output calibrated in microstrain units.

Normal operation/calibration procedure is as follows:

1. Gages are affixed, connected, and supplied the desired excitation. Open gages, if present, are indicated by the panel alarm. Gage Factor and Gage Resisatnce controls are set.

2. Before starting the actual test, the following optional steps may be taken:

   a. Gage voltage may be monitored at the panel test points. This measurement constitutes a simultaneous check on gage (plus wiring) resistance and excitation current. This procedure is normally not required because gage excitation current is precisely controlled, with less than 1% long term drift.

   b. CAL signal may be introduced to assure operating amplifiers and provide a full scale reference.

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SECTION 2

OPERATING INSTRUCTIONS

2.1 MOUNTING

The Model 471 is a plug-in module designed to operate in a Model S11 w/option 01 seven channel mounting frame or a Model S21 w/Option 01 three channel portable case. In either frame, a Model P16 Power Supply plugs into the extreme left slot, with the remaining slots available for mounting 471 amplifiers. In this configuration, the Power Supply provides dc power and a calibration signal to all amplifiers. The reference supply for the bridge excitation current is located on the rear of each mounting frame.

2.2 OPERATION

CAUTION: The front panel BNC is intended ONLY to be used for checking gage voltage, and should NOT be used for connecting to the strain gage.

Before operation, the following should be considered:

A. The 25 ma gage excitation delivers superior noise performance and greater sensitivity. It should not be used where gate rating is exceeded, when gage resistance exceeds 400 ohms, or when full scale microstrain of over 3K is anticipated.

B. The amplifier CAL range position serves as a check on amplifier calibration and dial settings. It should not be used with input signal applied, as errors will result. There will be no input signal if Gage Current is set to 0.

To operate, the following sequence is recommended for each channel (starting before gages have been connected).

1. Turn on power

2.* Check Open Gage Alarm operation with gage excitation control set to 2.5 ma and 25 ma.

3.* Set Gage Factor dial and Gage Resistance dial (in 100's of ohms) to gage parameters.

4.* Set Gage ma to 0 ma.

5.* Connect gage.

6. Set Calibrate/Operate switch and Power Supply to CALIBRATE 1.0 volt peak. This is useful as an overall amplifier-recorder calibration. This test is independent of range setting.

7.* Considering (A) above, select gage excitation of 2.5 or 25 ma. The Gage ma control also serves as range multiplier. Open gage alarm should be out. Allow 30 seconds for stabilization. This setting should not be changed during shock or vibration test or an additional stabilization period will be required.

8. Set Range Switch to anticipated full scale microstrain. (If gage excitation is 2.5 ma, multiply Range Switch setting by 10.)

9. Start Test. Range Control (but not Gage ma) may be altered as required with negligible stabilization time required. (NOTE: after initial stabilization, any channel will recover immediately from input overload to 30,000 microstrain.) Should Open Gage Alarm light during test, the DC voltage at the input has exceeded approximately 12 volts, and the gage or its electrical connections may be assumed to be open.

*If tests are to be resumed after setup through Step 7 has been completed, these steps may be omitted.

SECTION 3

THEORY OF OPERATION

3.1 INTRODUCTION

Figure 1 is a functional block diagram showing the basic components of the Model 471 Strain Gage Amplifier.

Because a constant current source is used to excite the strain gage, the current through the gage is constant and independent of the gage resistance and wiring resistance. Since the input signal is AC coupled to the input amplifier, the only voltage "seen" by the amplifier is defined by:

(1) $e = I \triangle R$

Where e is the peak AC voltage across the gage

I is the gage excitation current (DC)

$\triangle R$ is the peak value of change in gage resistance

Gage factor is defined as follows:

(2) $$GF = \frac{\frac{\triangle R}{R}}{\frac{\triangle L}{L}}$$

Where $\frac{\triangle R}{R}$ is per unit change in gage resistance

$\frac{\triangle L}{L}$ is incurred strain

Solving (2) for $\triangle R$ in (1) yields

(3) $$e = (GF)(IR)\left(\frac{\triangle L}{L}\right)$$

From (3) it is seen that the AC voltage at the amplifier input is directly proportional to strain.

Voltage at the amplifier output is

(4) $$E = A\ (GF)\ (IR)\ \left(\frac{\triangle L}{L}\right)$$

Where A is amplifier voltage gain.

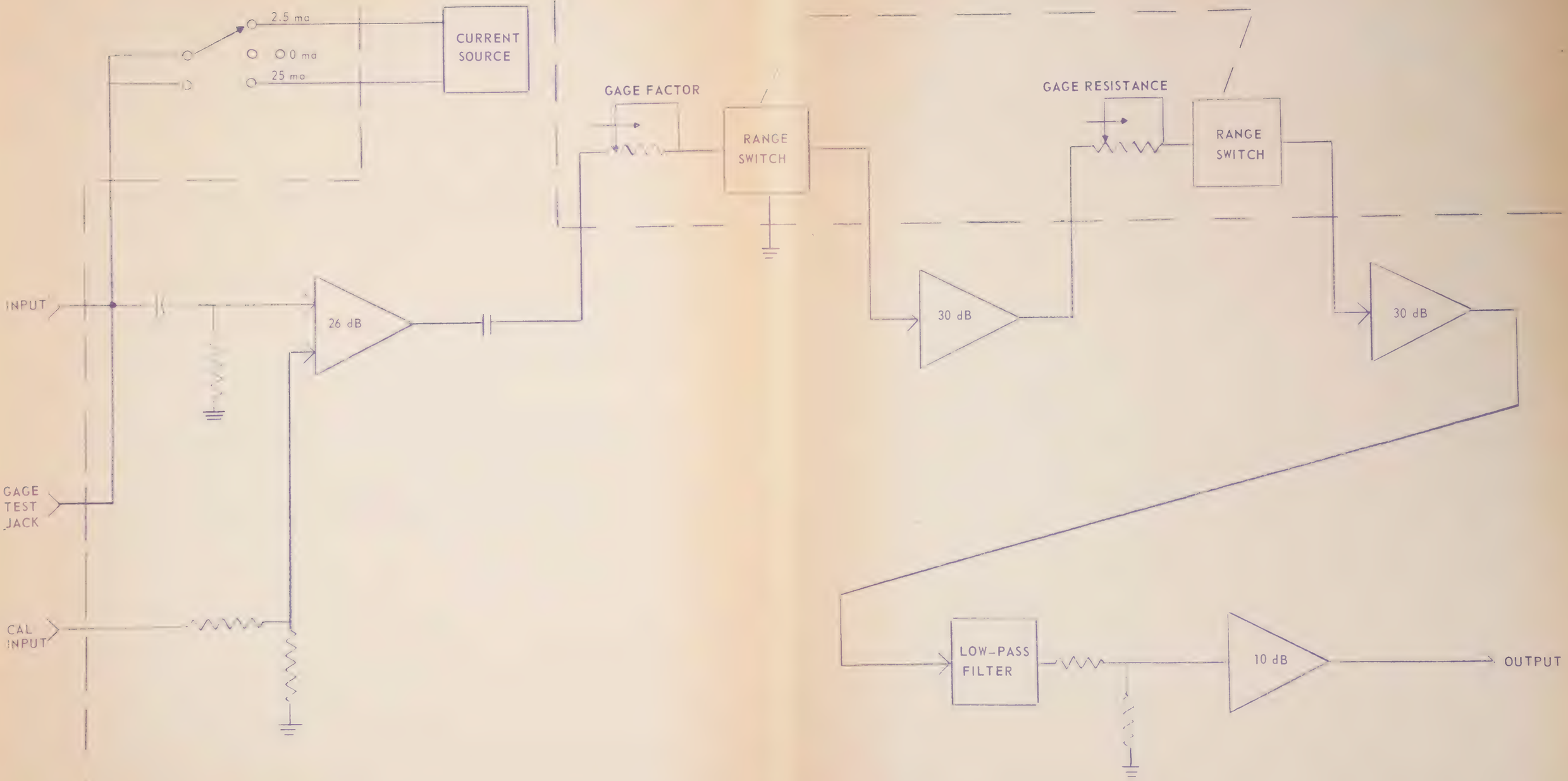


FIGURE 1 MODEL 471 FUNCTIONAL BLOCK DIAGRAM

If amplifier gain is set inversely proportional to R and GF (this is done by the multi-turn dials), and sufficient gain provided to deliver 1 volt out for the desired full scale strain range, the resulting amplifier output in volts will be proportional to strain, and will be normalized for the particular gage being used.

3.2 FUNCTIONAL DESCRIPTION

Four amplifier sections serve to give an overall maximum gain of 40,000 when the microstrain full scale switch is set on 10, GF dial set on 1, and the Gage Resistance dial set to 100 ohms. The gain is step variable down to a minimum of approximately 3.33 when the microstrain full scale switch is set on 3K, GF dial set on 4, and the Gage Resistance dial set on 1000 ohms. The output of the system is read directly in microstrain units full scale (corresponding to 1 volt peak out).

CONTROLS

Microstrain Full Scale Control - The microstrain full scale control has seven positions from which to select. The positions are step variable from 10 microstrain units full scale to 3K microstrain units full scale.

Gage ma Control - The gage ma control is a rotary switch which serves as a multiplier for the microstrain full scale control. When the switch is in the X1 position, the strain gage receives 25 ma of current and the microstrain full scale position is multiplied by a factor of 1. When this switch is on the X10 position, the strain gage receives 2.5 ma of current and the microstrain full scale position is multiplied by a factor of 10. When the switch is on the zero position, the strain gage receives no current.

Gage Factor - The gage factor dial is a multi-turn potentiometer which is set for gage factors, normally in the 1 to 4 range, depending upon the gage factor of the specific strain gage used.

Gage Resistance - The gage resistance dial is a 10 turn potentiometer which is set from 1.00 to 10.0 corresponding to gage resistance from 100 ohms to 1000 ohms.

SECTION 4

MAINTENANCE AND CALIBRATION

4.1 INTRODUCTION

Unless the maintenance is performed by persons familiar with solid state circuitry including insulated gate field effect transistors, it is recommended that the amplifier be returned to the factory for servicing.

4.2 GAIN ADJUSTMENT

A. Set Gage ma Control to 0 ma.

B. Set input to 10mV rms at 1 kHz.

C. Set Gain to 3kμ strain FS, Gage Factor and Resistance to 1.0.

D. Adjust R47 on the amplifier main card until output reads 1.333V rms.

E. Remove input and set Power Supply Mode switch to CALIBRATE. Terminate input with gage, resistance, or short.

F. Adjust R14 on the amplifier main card for an output of 1.00V peak. Check relay for operation by turning gage factor and resistance factor pots - no gain changing should occur when in CAL mode.

4.3 GAGE LINEARITY ADJUSTMENT

A. Set RANGE TO 3kμstrain, GAGE FACTOR and RESISTANCE to 1.

B. Adjust input signal for 1 kHz, 1V rms at output.

C. Set GAGE FACTOR to 4 and adjust R36 until output is 250mV rms.

D. Set GAGE FACTOR to 1 and readjust input for 1V rms at output.

E. Set GAGE RESISTANCE to 10 and adjust R39 until output is 100mV rms.

4.4 OUTPUT OFFSET

A. With no input and RANGE at 3k μstrain, monitor the output dc level with a digital voltmeter.

B. Adjust R51 until output dc offset is less than 1 mV.

4.5 REFERENCE ADJUSTMENT

A. Monitor the Reference Test Point on the rear of the mounting frame with a digital voltmeter.

B. Set Reference Adjust Potentiometer for 10.8V ±10mV.

NOTE: Reference should be allowed to settle each time the potentiometer is adjusted.

SECTION 5

GALVO OPTION

5.1 GENERAL DESCRIPTION

Galvonometer Output. Factory modification consists of adding a PC card containing a power amplifier suitable for driving long lones or galvonometers with a linear output of ±5 volts peak and ±85 ma peak with a current limit of 100 ma pk. A front panel screwdriver adjustment is added to permit the galvo output to be adjusted from 0.1 to 1.0 times the amplifier output. For further information refer to 5.2.

5.2 OPERATING INSTRUCTIONS

The typical galvonometer is a low impedance current operated device with a sensitivity expressed in units of deflection per unit of current. For operation of the galvonometer an external damping resistor is selected for fast response and limited overshot and is generally about 64% of critical damping. The galvonometer amplifier is a low impedance device, less than 1 ohm, thus the required damping can be connected directly to the galvonometer. Before setting the galvonometer adjustment of the 471, the peak voltage required at the galvo output must be ascertained:

			(Example)
a.	Galvo sensitivity, S	_____	(.025"/ma)
b.	Galvo resistance, Rg	_____	(24 ohms)
c.	Damping resistance, Rd	_____	(26 ohms)
d.	Recorder fullscale deflection, D	_____	(2")
e.	Galvonometer fullscale current, $I = \frac{D}{S}$	_____	$(\frac{2"}{.025"/ma} = 80$ ma)
f.	Peak voltage required at galvo output, V (V = I (Ra+Rg))	_____	(.08) (24+26) = 4.0 volts

In the above example, the galvonometer output must have 4.0 volts peak available, and to do so the tape output must have at least 4.0, inasmuch as the maximum galvo output is equal to the tape output. The fullscale tape output is internally selected via a jumper (See Figure 5.2) to give 5.0 V peak output and the amplifier gain recalibrated.

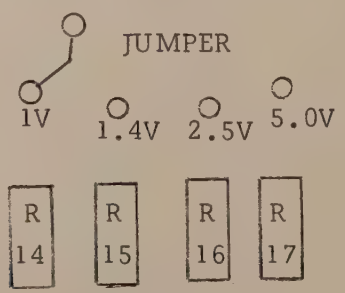


FIGURE 5.2

1. Select the galvo, damping resistor, etc. described in Figure 5.2 and select the appropriate fullscale output range. (Recalibrate the amplifier gain if the jumper is changed)

2. Set the galvo adjustment to minimum (full counterclockwise).

3. Connect the galvo with appropriate series damping resistor to the galvo output.

4. Depress calibrate switch on the P16 to obtain a fullscale output signal.

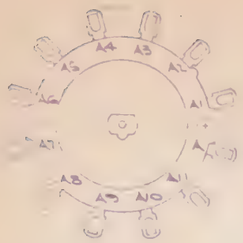
5. Increase galvo adjust until fullscale operation is obtained on the recorder.

6. Fullscale deflection on the galvo recorder now corresponds to the input in engineering units indicated on the 471 Range switch (for sinusoidal signals).

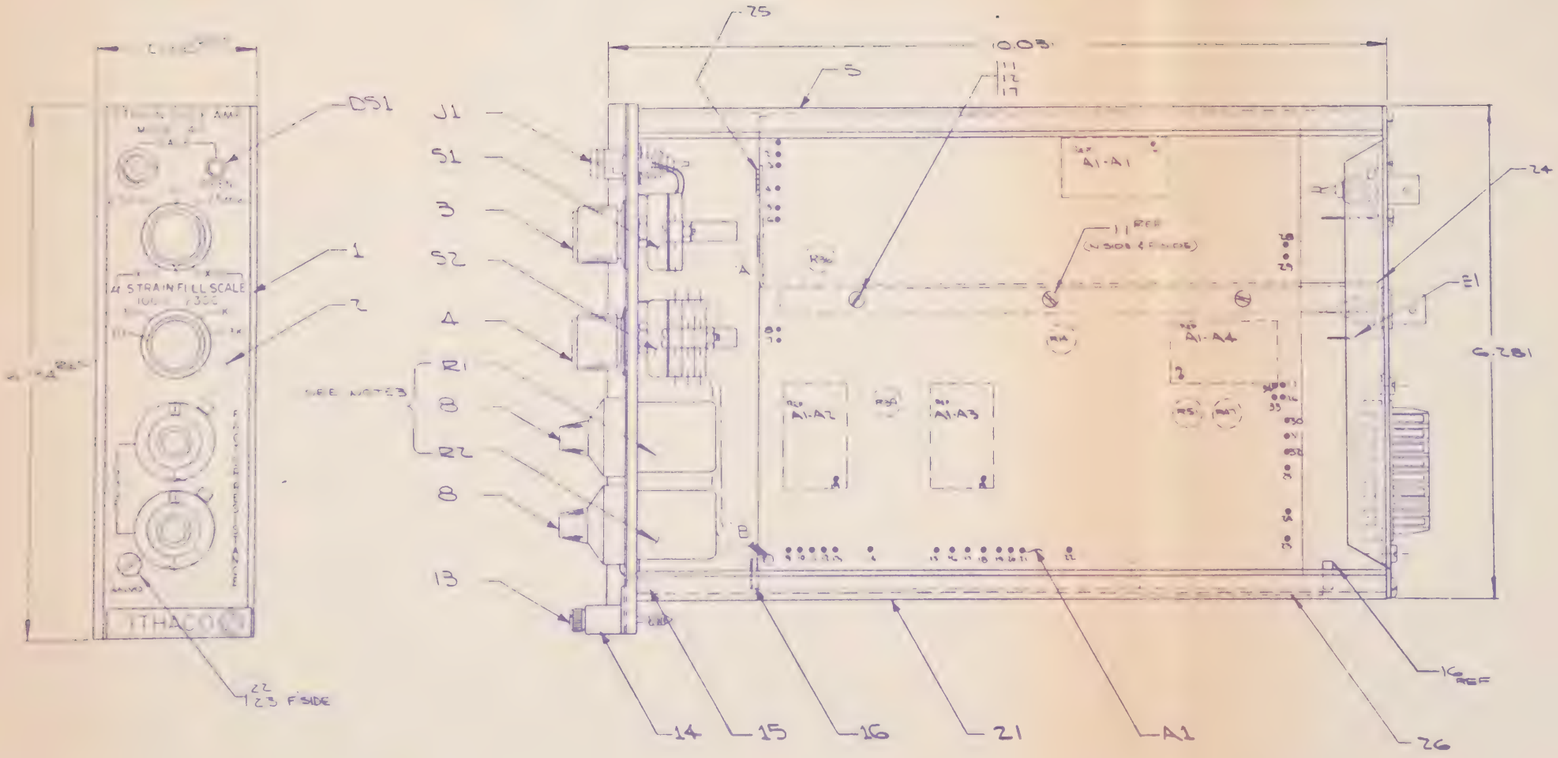
5.3 THEORY OF OPERATION

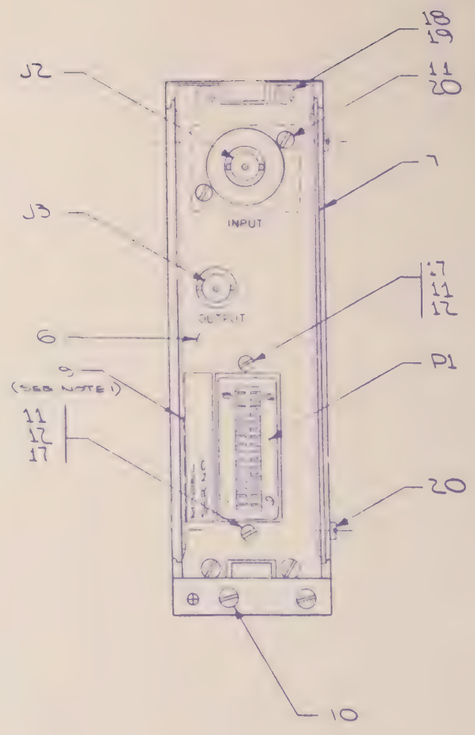
When the galvo option is included, a front panel galvo adjust is provided, R2 which serves as a attenuator on the output of the 471. This signal is used to drive the unity gain galvo driver, C30853. Provisions are made for fine adjustment of current gain limits.

REVISIONS			D41001
SYM	DESCRIPTION	DATE	APPROVAL
A	[illegible]	6-6-72	
B	ADDED R7 & MOUNTING PARTS PER E.C.N. 7221 CTY OF PTS WAS 2 NOW 1 QTY OF PTS WAS 2 NOW 21 21	7-30-72	
C	CHG PT 2 & ADD PT 22	9-28-72	
D	ADDED TERMINALS	[illegible]	
E	REVISED PER ECN 7577	5-14-73	
F	(UNNAMED POT LOCATION) CHANGED TO R1	[illegible]	
G	REV/ECN 7683	11-1-76	
H	REV/ECN 7770	8-27-77	



WIRING VIEW, SWITCH S1 & S2





G1 ASSEMBLY

NOTES:

1. TYPE IN MODEL NO & SERIAL NO AS REQUIRED. APPLY WITH TRICHLORO-ETHYLENE SOLVENT
2. ASSEMBLE PER STD SHOP PRACTICES
3. SET PART B AT "1" WHEN R1 & R2 ARE SET TO THEIR MAX. CCW POSITION

SEE SEPARATE PARTS LIST

A10-1
A10-2
A10-4
A1

		MAT'L: —	ASSY, STRAIN GAGE AMPL. MODEL 471
		FIN: —	FMF 40-7577
		SCALE: FULL	DRAWN BY TLT Nov 19, 1971
ELEM. DIAGRAM	471	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± DECIMALS ± ANGLES ±	APPROVAL: DFTG ENG.
REFERENCE DWG.	USED ON		ISSUE DATE Dec 14, 1971
APPLICATION			

ITHACO, INC.
ITHACA, N.Y.

D41001

CONT ON SH F SH NO 1

REVISIONS			D40999
ZONE	SYM	DESCRIPTION	
	A	[illegible]	
	B	[illegible]	
TP	C	ADDED [illegible]	
3C	D	NEW/LEN 2735 CL 3 4 71	

PWR-SOL B2078261 A1

-15V DEC

+15V DEC

S2-A

S2-B

S2-C

S2 POSITIONS

POS	RANGE
1	10M STRAIN
2	30M STRAIN
3	100M STRAIN
4	300M STRAIN
5	1K STRAIN
6	3K STRAIN

A2 B2095361 30 db ATT/AMP

A3 B2095361 30 db ATT/AMP

MOTHERBOARD A1 D41000G1

J2 INPUT

J1 TEST

CAL

+REF

-REF

TIE PT. ONLY (REF)

51A

2.5MA

FRONT PANEL

TIE POINTS ONLY

SHIELD TO GND

A4 B2162361 OUTPUT STAGE

J3 OUTPUT

K1 F ROST #CR4.005A-24 VDC

NOTES
1. UNLESS OTHERWISE SPECIFIED
   A. DIODES ARE IN4148
   B. RESISTORS ARE 1/4W, 5%, STYLE RC07
      * INDICATES 1/8W, 1% STYLE RN55C

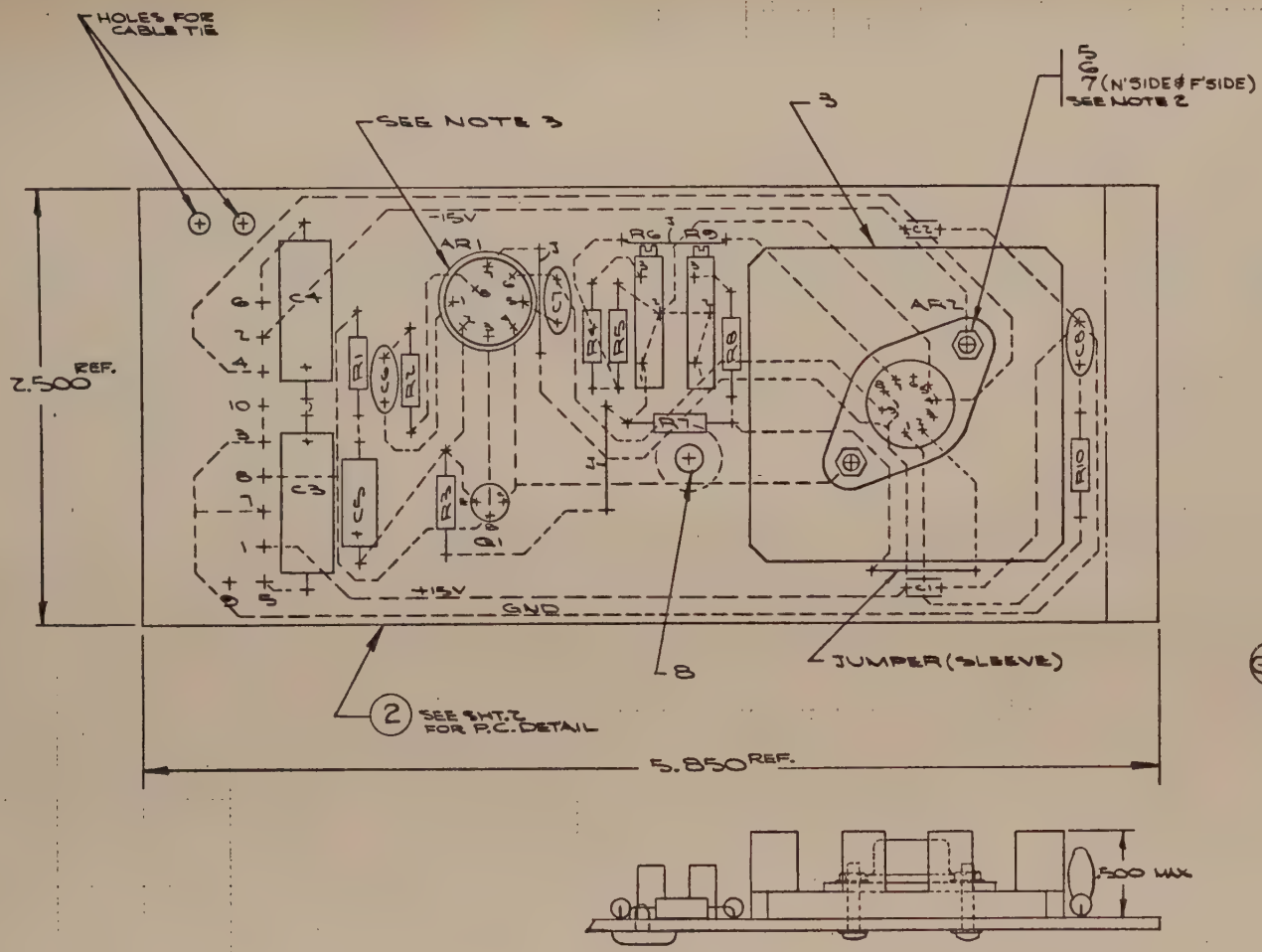
RL-1A11086	471	MATL	ELEM. DIAG. STRAINGAGE AMPL. MODEL 471
ASM D41001G1	471	FIN	FMF JOB# 49-7577
REVD ASM D41000G1	471	SCALE	DRAWN BY TLT NOV 17, 1971
REFERENCE DWG	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64 .010 ± 1/2°	CHECKED BY
APPLICATION			APPROVAL ENG
			ISSUE DATE Dec 13, 1971

ITHACO, INC. ITHACA, N.Y.

CODE IDENT NO D 40999

SHT

ZONE	SYM	DESCRIPTION	DATE	APPROVAL
	A	REVISED & REDRAWN PER ECN. NO. 1197	10-8-71	
	B	REV/ECN 12404-J 11-8-71	11-8-71	
6-B	C	REV/ECN 2713. BM'CM 12-26-74 AT ITEM 7 ADDED N'SIDE'S.	12-27-74	
	D	REV/ECN 2816	7-25-77	



(G1) ASSEMBLY, AS SHOWN

NOTES:

1. ASSEMBLE PER ITHACO STANDARD SHOP PRACTICE.
2. APPLY ECCOTHERM TC-4 BETWEEN AR2 AND HEATSINK.
3. FORM LEADS USING 818000001 (IC PAD) BUT ASSEMBLE AR1 WITHOUT PAD.

SEE SEPARATE PARTS LIST

A10-2
A10-4
A1

ELEM DIAG C30852	461	
REFERENCE DWG	USED ON	
ITH 238 APPLICATION		

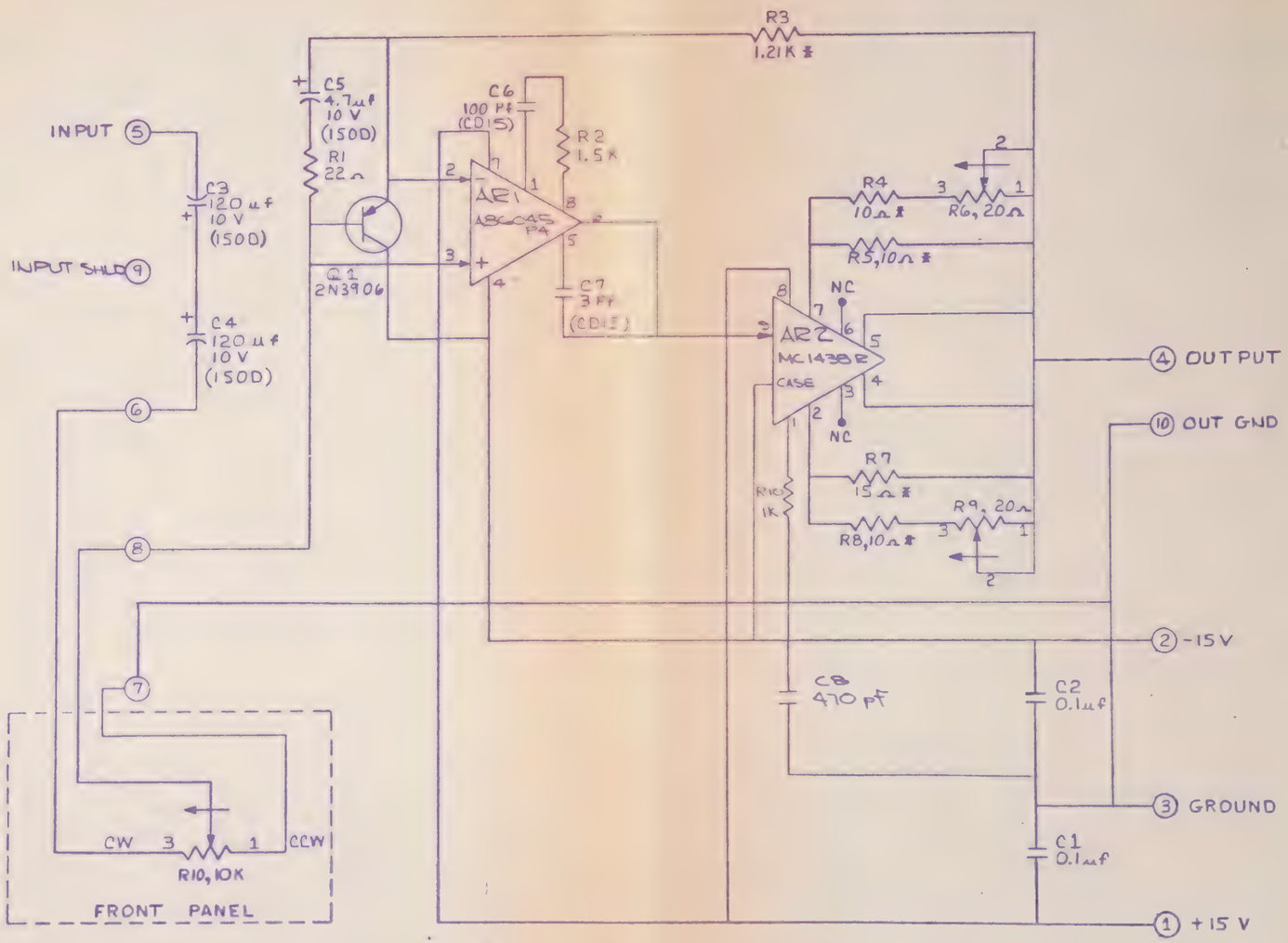
MAT'L:
FIN:
SCALE: 2:1
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .010 ANGLES ± 1/2°

ASM. CARD
GALVO DRIVER
FMF: JOB# 30-1863
DRAWN BY: I.L. FULLER OCT. 7, 1971
CHECKED BY:
APPROVAL: DFTG. ENG.
ISSUE DATE: Oct 8, 1971

ITHACO, INC.
ITHACA, N. Y.
CODE IDENT. NO 26502
C 30853
SHT 1 OF 2

LIMING 44-132 14830

REVISIONS		C 30852 CONT ON SH. — SH NO 1	
SYM.	DESCRIPTION	DATE	APPROVAL
A	[illegible]	[illegible]	[illegible]
B	REV PER ECN 1240 [illegible]	11-18-71	[illegible]



NOTE:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4W, 5%
2. RESISTORS MARKED WITH * ARE 1/8 W 1%

ASM C30853	461	SCALE: NONE	ELEM DIAG GALVO DRIVER FMF 1863
REFERENCE DWG	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± ± ±	DRAWN BY [illegible] 12 16 69
APPLICATION			APPROVAL: DFTG. [illegible] ENG. [illegible]
			ISSUE DATE [illegible]

ITHACO, INC.
ITHACA, N. Y.

A1
A10

C 30852

CONT ON SH — SH NO 1

REV. NO.	TITLE
A11202 SHT 1 OF 5	MODIFICATION INSTRUCTION AMPLIFIER, OPTION G FIRST MADE FOR MODEL 471 (9132-80)

REVISIONS

B — ADDED C31497P1 SHIELD — 2-15-78

SCOPE: THIS DOCUMENT IS ESTABLISHED AS A SOURCE OF INFORMATION FOR THE PURPOSE OF INCLUDING AN OPTION IN A STANDARD 471 AMPLIFIER. (ASM DWG NO. D41001G1)

DEFINITION: OPTION G IS A GALVO DRIVER. THIS OPTION PROVIDES THE CAPABILITY OF DRIVING A GALVANOMETER OF UP TO 100ma.

GENERAL: THE FOLLOWING TEXT CONTAINS ENOUGH INFORMATION IN THE FORM OF PARTS LIST, ASSEMBLY VIEWS, AND RUNNING LISTS TO, WHEN COMBINED WITH THE DOCUMENTATION OF A STANDARD 471 AMPLIFIER, MANUFACTURE A COMPLETE AMPLIFIER TO CUSTOMER SPECIFICATIONS.

REFERENCE DWGS:

D41001G1	ASM 471 AMPL
D40999	ELEM DIAG 471
C30853G1	ASM CARD GALVO DRIVER
C30852	ELEM DIAG GALVO DRIVER
C31497P1	SHIELD

A1

PRINTS TO

MADE BY	APPROVALS		
W.THURSTON 3-27-72			A11202
ISSUED March 30, 1972			SHT 1 OF 5

ITH-21M

ITHACO INC ITHACA NY

PARTS LIST FOR	TITLE	JOB NO
A11202	MODIFICATION INSTRUCTION AMPLIFIER, OPTION G	
SHT 2 OF 5	FIRST MADE FOR 9132-80	LOT SIZE

ITEM	IDENT NUMBER	DESCRIPTION OR NAME	UNIT QTY	JOB QTY	PURCH ORDER	UNIT COST	TOTAL
A3	C30853G1	ASM, CARD, GALVO DRIVER	1				
R3	817801017	POTENTIOMETER 1K	1				
100	A10302P1	SPRING, CARD RETAIN'G	1				
102	812806007	GROMMET, CATERPILLER 3.50LG.	1				
103	A11064P1	LABEL	1				
104	C31497P1	SHIELD (MOTHERBOARD)	1				

INSTRUCTIONS:

1. REPLACE THE MOTHERBOARD SHIELD (DA10061G1 PT24, C30565P1) WITH ITEM 104 SHIELD, C31497P1.

DISTR	SYM	REVISIONS		
A1	A	ADDED ITEM 103 ECN 10-25-72	10/27/72	
	B	ADDED ITEM 104 & E INSTRUCTIONS ECN	2-15-73	

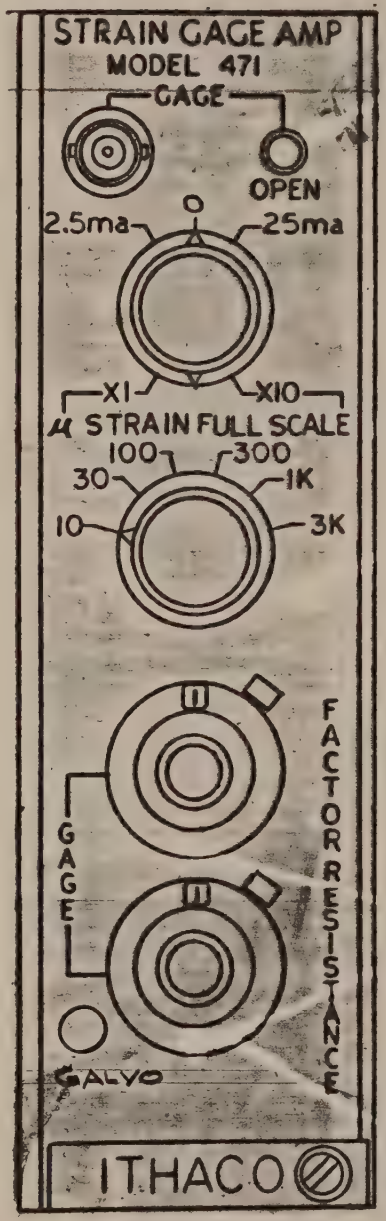
MADE BY	APPROVALS	PARTS LIST FOR
W. Thurston 3-27-72		A11202
ISSUED March 30, 1972		SHT 2 OF 5

ITHACO INC ITHACA N Y

REV. NO.	TITLE FRONT PANEL VIEW
A11202	AMPLIFIER, OPTION G
CONT. ON SHEET 4 SH. NO. 3	FIRST MADE FOR 9132-80

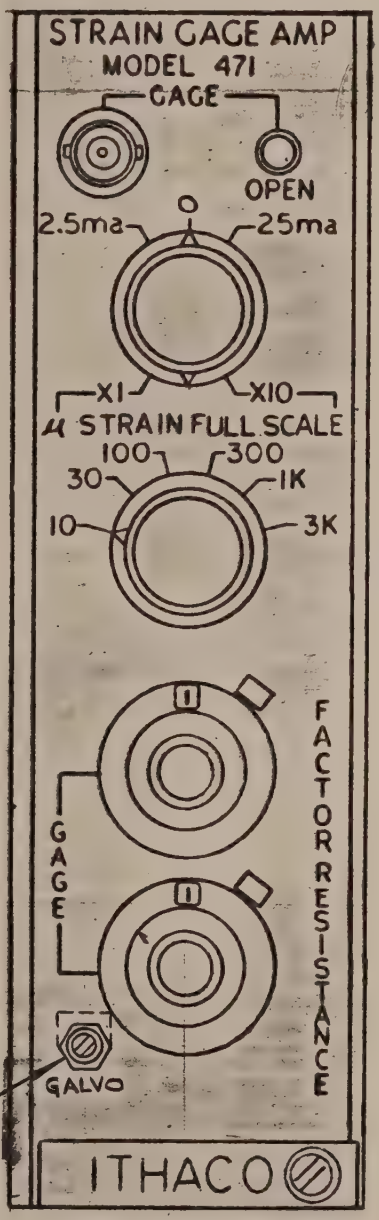
REVISIONS

B	DELETED ITEM 10 (SET PNLS)	2-15-78



STANDARD

R3 WIRE PER SH 5



OPTION G ADDED

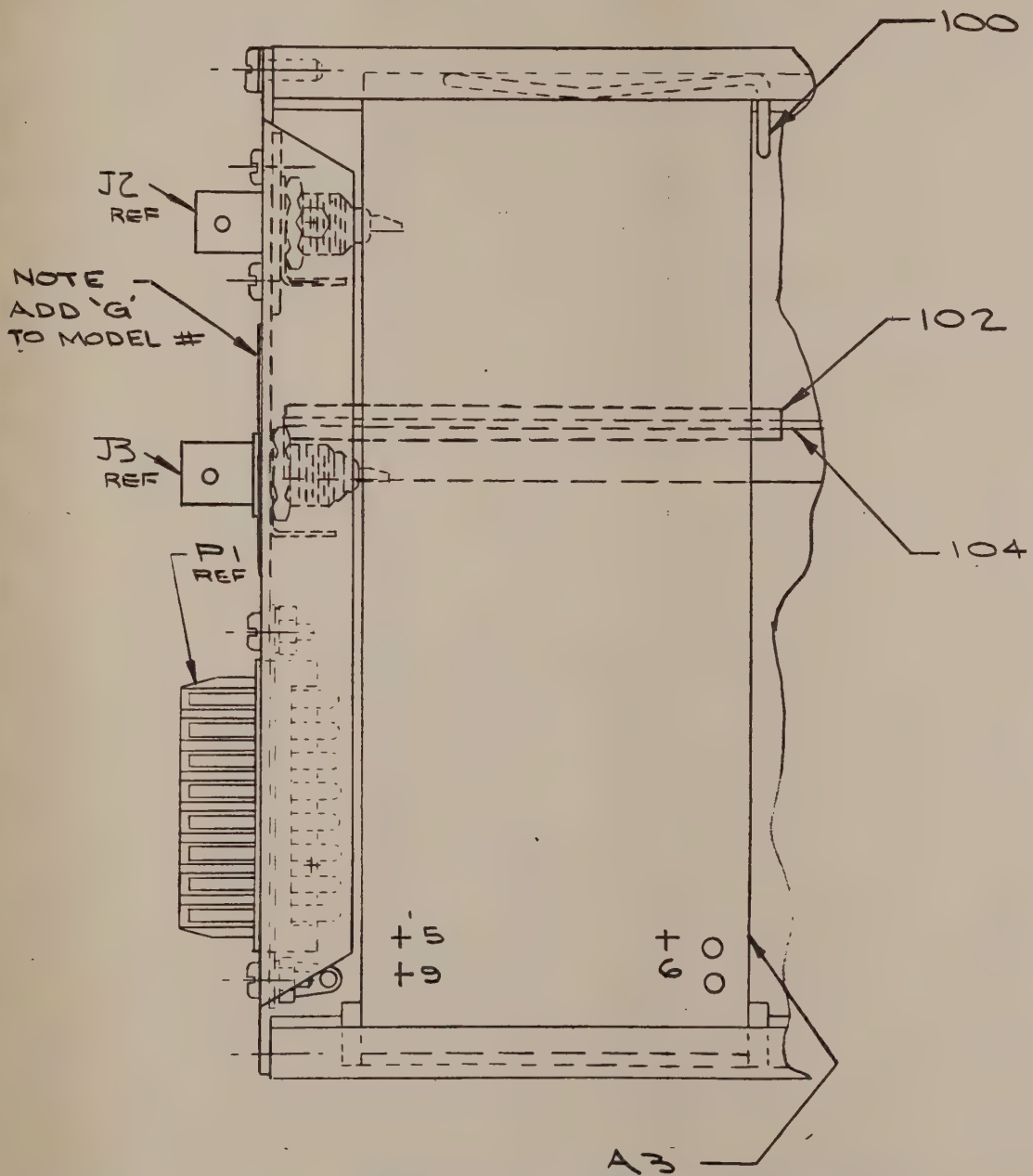
A1

PRINTS TO

MADE BY	APPROVALS	
W. THURSTON 3-27-72		A11202
ISSUED March 30, 1972		CONT. ON SHEET 4 SH. NO. 3

ITHACO INC ITHACA N Y

REV. NO.	TITLE AMPLIFIER VIEW
A11202	AMPLIFIER, OPTION G
CONT ON SHEET 5 SH. NO. 4	FIRST MADE FOR 9137-82



REVISIONS

B	ADDED ITEM 103 JHB 2-15-78	2-15-78

A1
PRINTS TO

MADE BY	APPROVALS		
W. THURSTON 3-27-72	JS		A11202
ISSUED March 30, 1972	RAB		CONT. ON SHEET 5 SH. NO. 4

ITH-248

ITHACO INC ITHACA N Y

REV NO

A11202
SHT 5 OF 5

TITLE RUNNING LIST
AMPLIFIER OPTION G

FIRST MADE FOR 9132-80

WIRE NO	AWG	COLOR BODY	1ST TRACER	CABLE ROUTING	FROM	TO	FUNC	LGTH
50	#24	RED			A3-1	P1-9	+15V	7 1/2
51	"	VIO			A3-2	P1-1	-15V	6
52	"	BLK			A3-3	P1-2	GND	6 3/4
53	"	YEL			A3-4	P1-7		7 1/4
54	#24	BLU			A3-5	P1-8		9
55	---	---			R3-GRN	A3-6		8 1/2
56	---	---			R3-YEL	A3-7		9 3/4
57	---	---			R3-RED	A3-8		9 1/2

REVISIONS

A | ADDED WIRE LGTHS | JJG 10-27-72

A1

PRINTS TO

MADE BY W. Thurston 3-27-72

ISSUED March 30, 1972

APPROVALS

A11202
SHT 5 OF 5

ITH-85 REV 3/72

WARRANTY

ITHACO Inc. warrants each instrument to be free of defects in material and workmanship for a period of one year after shipment to the original purchaser; batteries are specifically excluded. Liability under this warranty is limited to repairing or adjusting any instrument returned to the factory for that purpose. The warranty of this instrument is void if the instrument has been modified other than in accordance with written instructions from ITHACO, or if defect or failure is judged by ITHACO to be caused by abnormal conditions of operation, storage or transportation.

This warranty is subject to verification by ITHACO, that a defect or failure exists, and to compliance by the original purchaser with the following instructions:

1. Before returning the instrument, notify ITHACO with full details of the problem; include model number and serial number of the instrument involved.

2. After receiving the above information, ITHACO will give you shipping instructions or service instructions. After receipt of shipping instructions, ship the instrument to ITHACO. Full liability for damage during shipment is borne by the purchaser. It is recommended that instruments shipped to us be fully insured and packed surrounded by at least 2 inches of shock-absorbing material.

ITHACO reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

This warranty is expressly in lieu of all other obligations or liabilities on the part of ITHACO, and ITHACO neither assumes, nor authorizes any other person to assume for it, any liability in connection with the sales of ITHACO instruments.

ITHACO INC.
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